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No. 9.

HANDBOOK
FOR
REGULATED POWER SUPPLY
MODEL 513

A.P.T

**ELECTRONIC
INDUSTRIES
LIMITED**

**CHERTSEY ROAD
BYFLEET • SURREY
PHONE: BYFLEET 4411/2/3/4
GRAMS: APTRAN, BYFLEET**

Designers and Manufacturers of Specialised Electronic Apparatus

MP MASTER



MA22647

SPECIFICATIONMains Supply

200-250 volts, 45-65 cycles Single-phase A.C.
VA Input approximately 650VA. max.

The voltage selector on the Front Panel allows the unit to be adjusted to the nominal voltage of the local supply, in steps of 10 volts.

Mains Variations

The unit is designed to maintain its full rated performance irrespective of mains voltage variations up to a maximum of $\pm 10\%$ about the nominal voltage for which the selector is set. The output is unaffected by mains frequency within the range 45-65 cycles.

+ve Stabilised D.C.

The Unit covers the range 0-500 volts, in five ranges. The maximum permissible output current is 500mA. With respect to mains voltage variations, the output voltage is stabilised to within $\pm 0.002\%$.

The effective output resistance of the supply is less than 0.02 ohm.

The residual output ripple is less than 1mV. R.M.S.

+ve Unstabilised D.C.

Smoothed unstabilised D.C. is available according to the setting of the Voltage Range Switch. The settings are as follows:-

<u>Voltage Range</u>	<u>Nominal Voltage (at 500mA)</u>
0-100	200
100-200	300
200-300	400
300-400	500
400-500	600

The maximum permissible load is 500mA. on all ranges.

If current is drawn from the Stabilised and Unstabilised terminals simultaneously, the total of the two currents must not exceed 500mA.

-ve Stabilised D.C.

The negative stabilised supply is required primarily as a voltage reference source for the main +ve stabiliser circuit, but provision is made for small output currents to be drawn for external use.

The fixed 250 volt output is rated for a maximum load current of 25mA. and the variable 0-250 volt output for a maximum load current of 1mA.

The actual voltage available on the negative line is adjusted by the 'Set Range' control, RV2, to a value which permits the +ve Stabiliser to operate over its correct ranges. If the unit is in normal condition the negative voltage will not differ from 250 volts by a significant amount.

-ve Stabilised D.C. (cont'd)

With respect to mains voltage variations, the negative supplies are stabilised to within $\pm 0.002\%$. The effective output resistance at the 250 volt terminal is less than 0.01 ohm. The 0-250 volt variable output is derived from a 100,000 ohms potentiometer and this output therefore has a high effective resistance.

The residual output ripple on the 250 volt line is less than 1mV R.M.S.

Unstabilised A.C.

This supply is nominally 6.3 volts R.M.S. and the maximum output current is 10 Amps. The unit should not be operated with this supply at a potential more than 500 volts D.C. with respect to earth.

OPERATION

Before connecting to the mains supply, check that the Voltage Selector on the Front Panel is correctly set for the local mains voltage. Put all three switches on the front panel to the OFF position.

Connect the unit to the mains supply by means of the Mains Lead provided, noting that the Red and Black wires are Line and Neutral respectively and that the Green wire is Earth.

Put the MAINS switch on the Front Panel to the ON position and note that the red indicator lamp lights. Allow approximately 30 seconds for the valves to warm up before attempting to use the unit.

Always put the MAINS switch to the OFF position before changing the settings of the mains voltage selectors.

It should be noted that when the REG. switch on the Front Panel is put to the OFF position a resistance of 68 ohms is shunted across the output terminals of the stabilised supply. The purpose of this is to discharge the capacitors across the output and to ensure that the output voltage is virtually zero when the supply is switched off.

TECHNICAL

Metering

The Meter on the Front Panel is used to monitor both Voltage and Current in the +ve Stabilised D.C. Supply. The meter is switched by means of a two-position toggle switch.

The mechanical zero of the meter should always be set with the Mains switch at the OFF position. The zero adjuster on the meter should be set so that the meter pointer reads zero on the volts scale.

It will be noted that the zero marking on the Current scale is displaced with respect to the true zero of the meter. This is to allow for an internal bleed current of 16mA. which passes through the meter circuit.

Set Range

The 'Set Range' control, RV2, inside the rear of the unit is provided to take account of variations in valves type 85A2 (V13 and V14). This control is set at the factory and should not require re-adjustment unless V13 or V14 is changed.

Set Range (cont'd)

To check if RV2 is correctly set, put the Voltage Range Switch to the lowest setting and turn the Coarse Voltage Control fully anti-clockwise. Rotation of the Fine Voltage Control should now cause the output voltage to vary from 0 to 10 volts, with a small overlap at each end of the range. If the unit does not cover this range, or if the overlap is not approximately the same at each end of the range, RV2 should be adjusted slightly.

Hum Level

The Stabilised outputs are arranged as 'floating' supplies and may be operated without an earth connection or with either pole earthed.

If the unit is operated with no pole connected to earth the output ripple may exceed the specification limit. This can be rectified by connecting a capacitor of about 0.1 μ F between earth and one of the output terminals.

Voltage Limit

When operated as a 'floating' supply, no output terminal of the Stabilised supplies should be operated at more than 1000 volts D.C. with respect to Earth.

PARTS LIST.

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ct. ef.	Description		Remarks.
<u>CAPACITORS</u>			
1	(0.05uF 1KV Wkg.	T.C.C. CP18W or Hunts B415K	) Parallel connected.
2	(0.1uF 1KV. Wkg.	T.C.C. CP48W. or Hunts B408K.	
3	100uF 450V. Wkg.	T.C.C. CE53PE.	
4	0.1uF 1KV. Wkg.	T.C.C. CP48W. or Hunts B408K.	
5	(0.1uF 1KV. Wkg.	T.C.C. CP48W. or Hunts B408K.	
6	NOT REQUIRED.		
7	NOT REQUIRED.		
8	100uF 450V. Wkg.	T.C.C. CE53PE.	
9	100uF 450V. Wkg.	T.C.C. CE53PE.	
10	0.1uF 1KV. Wkg.	T.C.C. CP48W. or Hunts B408K.	
11	0.1uF 1KV. Wkg.	T.C.C. CP48W. or Hunts B408K.	
12	100uF 450V. Wkg.	T.C.C. CE53PE.	
13	100uF 450V. Wkg.	T.C.C. CE53PE.	
14	NOT REQUIRED.		
15	NOT REQUIRED.		
16	0.1uF 350V. Wkg.	T.C.C. CP45N. or Hunts B406K.	
17	NOT REQUIRED.		
18	3.3pF 500V. Wkg.	Erie P100K.	
19	3.3pF 500V. Wkg.	Erie P100K.	
20	0.1uF 350V. Wkg.	T.C.C. CP45N. or Hunts B406K.	
21	2 x 0.1uF 350V. Wkg.	T.C.C. CP45N. or Hunts B406K.	
22	0.1uF 1KV. Wkg.	T.C.C. CP48W. or Hunts B408K.	(Parallel connected).
23	100uF 450V. Wkg.	T.C.C. CE53PE.	
24	100uF 450V. Wkg.	T.C.C. CE53PE.	
25	0.1uF 350V. Wkg.	T.C.C. CP45N. or Hunts B406K.	
<u>CHOKES</u>			
H1	10H 500mA.	A.P.T. Pt. No. G.604.	
H2	5H 125mA.	A.P.T. Pt. No. G.166.	
H3	5H 125mA.	A.P.T. Pt. No. G.166.	
<u>FUSES</u>			
1	10A. Cartridge	Belling & Lee. L1055/10A.	
2	.75A. Cartridge	Belling & Lee. L1055/750mA.	
3	.75A. Cartridge	Belling & Lee. L1055/750mA.	
<u>METER</u>			
1	0-500V)	1mA F.S.D. A.P.T. Pt. No. G.457.	
2	0-500mA)		
<u>PILOT LAMP</u>			
L1	6.3V. 0.115A. M.E.S. Bulb.	Osram OS.76.	
<u>RESISTORS, FIXED.</u>			
1	47 ohm $\pm 10\%$ 1W.	Morganite 'Y'	
2	100K ohm $\pm 10\%$ 1W.	Morganite 'Y'	
3	270K ohm $\pm 10\%$ 1W.	Morganite 'Y'	) Matched Pair $\pm 2\%$
4	270K ohm $\pm 10\%$ 1W.	Morganite 'Y'	
5	270K ohm $\pm 10\%$ 1W.	Morganite 'Y'	) Matched Pair $\pm 2\%$
6	270K ohm $\pm 10\%$ 1W.	Morganite 'Y'	

PARTS LIST

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Pt. No.	Description	Remarks.
<u>RESISTORS, FIXED, (Cont'd).</u>		
7	330K ohm)	) Series) Connect
	350K ohm) $\pm 2\% \frac{1}{2}W.$ H.S.	
8	4.7K ohm $\pm 2\% \frac{1}{2}W.$ H.S.	Radio Resistor H.S.3.
9	680K ohm $\pm 2\% \frac{1}{2}W.$ H.S.	Radio Resistor H.S.3.
10	220K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
11	NOT REQUIRED.	
12	470K ohm $\pm 5\% 1W.$	Morganite 'Y'
13	1K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
14	47 ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
15	10K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
16	68K ohm $\pm 5\% 1W.$	Morganite 'Y'
17	10K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
18	NOT REQUIRED.	
19	NOT REQUIRED.	
20	47 ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
21	47 ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
22	47 ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
23	47 ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
24	47 ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
25	1K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
26	470K ohm $\pm 5\% 1W.$	Morganite 'Y'
27	1K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
28	1K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
29	47 ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
30	1K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
31	1K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
32	100K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
33	NOT REQUIRED.	
34	100K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
35	NOT REQUIRED.	
36	68K ohm $\pm 5\% 1W.$	Morganite 'Y'
37	126K ohm $\pm 1\% \frac{1}{2}W.$ H.S.	Radio Resistor H.S.3.
38	220K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
39	24K ohm $\pm 1\% \frac{1}{2}W.$ H.S.	Radio Resistor H.S.3.
40	20K ohm $\pm 1\% \frac{1}{2}W.$ H.S.	Radio Resistor H.S.3.
41	180K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
42	Filament Shunt Resistor.	
43	7.92K ohm $\pm 1\% 6W.$ W.W.	A.P.T. Pt. No. G.328.
44	1.4K ohm $\pm 1\% 3W.$ W.W.	A.P.T. Pt. No. G.332.
45	1.4K ohm $\pm 1\% 3W.$ W.W.	A.P.T. Pt. No. G.332.
46	3.3M ohm $\pm 5\% 1W.$	Morganite 'Y'
47	4.44K ohm $\pm 1\% 3W.$ W.W.	A.P.T. Pt. No. G.326.
48	7.99K ohm $\pm 1\% 6W.$ W.W.	A.P.T. Pt. No. G.328.
49	220K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
50	Filament Shunt Resistor.	
51	180K ohm $\pm 10\% \frac{1}{2}W.$	Morganite 'S'
52	1.4K ohm $\pm 1\% 3W.$ W.W.	A.P.T. Pt. No. G.332.
53	1.4K ohm $\pm 1\% 3W.$ W.W.	A.P.T. Pt. No. G.332.
54	3.3M ohm $\pm 5\% 1W.$	Morganite 'Y'
55	4.56K ohm $\pm 1\% 3W.$ W.W.	A.P.T. Pt. No. G.316.
56	9 x .622K ohm $\pm 1\% 3W.$ W.W.	A.P.T. Pt. No. G.649.
57	4 x 6.22K ohm $\pm 1\% 6W.$ W.W.	A.P.T. Pt. No. G.220.
58	31K ohm $\pm 2\% 1W.$ W.W.	A.P.T. Pt. No. G.225.
59	68 ohm $\pm 10\% 1W.$	Morganite 'Y'
60	Meter Swamp Resistor.	

PARTS LIST

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Oct. Ref.	Description	Remarks
<u>RESISTORS, FIXED, Cont'd.</u>		
R61	Meter Shunt Resistor.	
R62	Meter Multiplier Resistor.	
R63	270K ohm $\pm$ 10% 1W. Morganite 'Y'	} Matched Pair $\pm$ 2%
R64	270K ohm $\pm$ 10% 1W. Morganite 'Y'	
R65	14K ohm $\pm$ 2% 3W. W.W. A.P.T. Pt. No. G.324.	

RESISTORS, VARIABLE

RV1	1K ohm $\pm$ 5% 4W. W.W. Linear.	Colvern CLR 5001/13.
RV2	1K ohm $\pm$ 5% 3W. W.W. Linear.	Colvern CLR 901.
RV3	100K ohm $\pm$ 10% 3W. W.W. Linear.	Colvern CLR 4001/13.

RECTIFIERS

MR1	4 x 725V. 300mA.	Westinghouse 14A282
MR2	2 x 250V. 70mA.	Westinghouse 15D88
MR3	2 x 500V. 70mA.	Westinghouse 15D83

SWITCHES

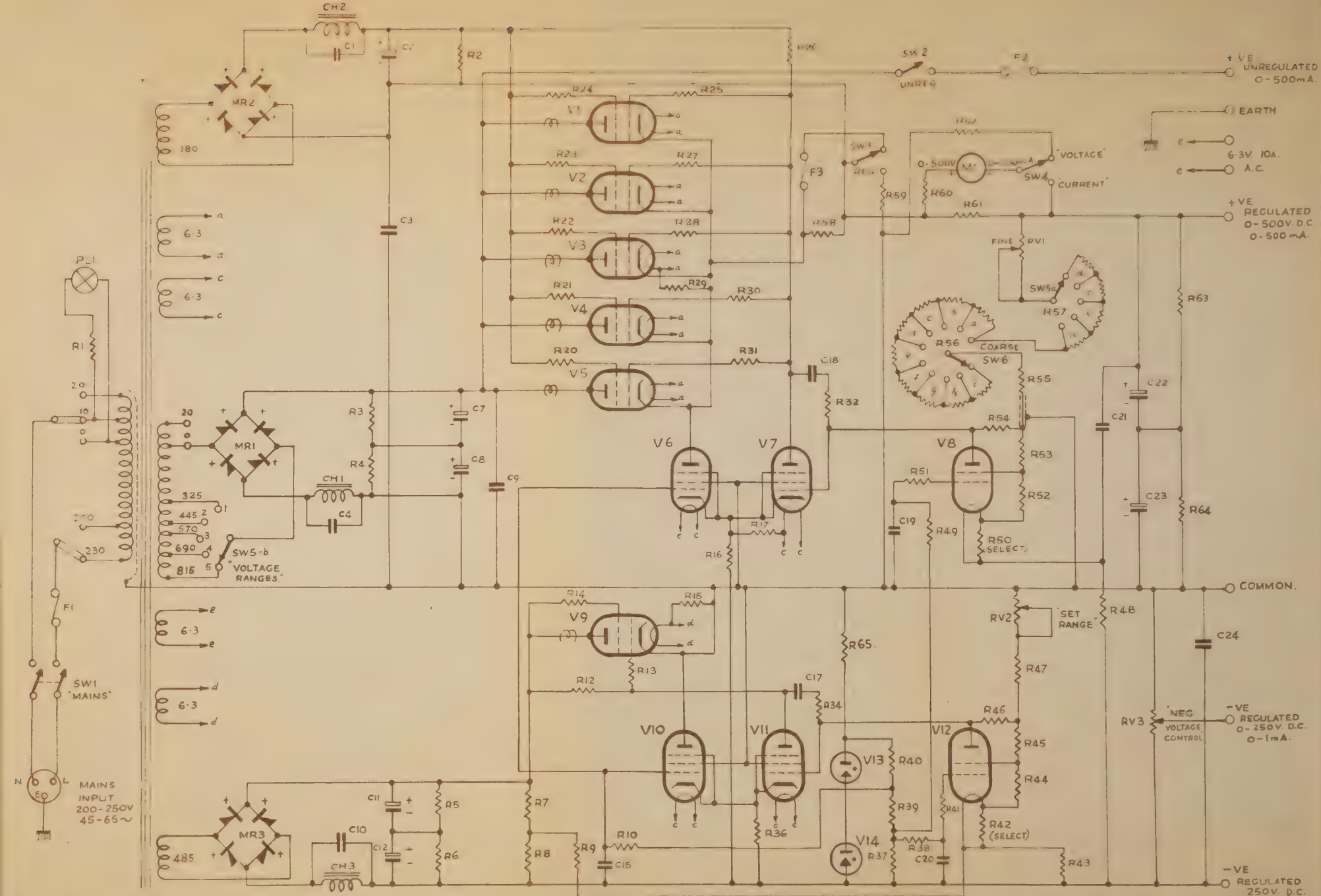
SW1	D.P. On-Off 10A. 250V.	Arrow 102P
SW2	S.P. On-Off 10A. 250V.	Arrow 102P
SW3	S.P. C/O 10A. 250V.	Arrow 102PXA
SW4	S.P. C/O 10A. 250V.	Arrow 102PX
SW5	2P. 5-way.	A.P.T. Pt. No. G.629.
SW6	S.P. 10-way	A.P.T. Pt. No. G.648.

TRANSFORMER

T1	H.T. Screen H.T. Bias and Heaters. A.P.T. Pt. No. G.602.
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VALVES.

<u>Commercial Type</u>		<u>Services Ref.</u>
V1	12E1 (Mazda)	CV.345
V2	12E1 (Mazda)	CV.345
V3	12E1 (Mazda)	CV.345
V4	12E1 (Mazda)	CV.345
V5	12E1 (Mazda)	CV.345
V6	EF91 (Mullard) Z77 (Osram)	CV.138
V7	EF91 (Mullard) Z77 (Osram)	CV.138
V8	XFW40 (Hivac)	CV.2260
V9	12E1 (Mazda)	CV.345
V10	EF91 (Mullard) Z77 (Osram)	CV.138
V11	EF91 (Mullard) Z77 (Osram)	CV.138
V12	XFW40 (Hivac)	CV.2260
V13	85A2 (Mullard)	CV.449
V14	85A2 (Mullard)	CV.449



ISSUE	DATE	CHANGES	DRAWN	TITLE
1	5/4/56	ORIGINAL ISSUE	TRAFFORD	ALL - POWER TRANSFORMERS LTD
2	13/12/57	R11, R18, 33, 35 & C16 NOT REQUIRED	CHAPMAN	CIRCUIT DIAGRAM
3	2/17/58	C 5, 6, 13 & 14, NOT REQUIRED	APPROVED	REGULATED POWER SUPPLY, MODEL 513

PDRAWING NO

B3893.

REGULATED POWER SUPPLIES

MODELS 510-513

TYPICAL INTERNAL ELECTRICAL MEASUREMENTS

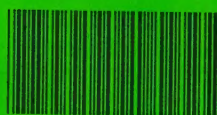
UNDER CORRECT WORKING CONDITIONS.

		<u>No-Load</u>	<u>Full-Load</u>
1. <u>VOLTAGE.</u>	H.T. POSITIVE TO COMMON. (Unregulated D.C. voltage across smoothing capacitance.)		
	Range: 0-100v.	260	195
	100-200v.	370	300
	200-300v.	490	415
	300-400v.	600	520
	400-500v.	695	610
2. <u>RIPPLE.</u>	H.T. POSITIVE TO COMMON. (R.M.S. voltage across smoothing capacitance) - (See Note iv).	0.5	1.5
3. <u>VOLTAGE.</u>	AUXILIARY SUPPLY POSITIVE TO MAIN H.T. POSITIVE LINE (Series Valve Screen Grid D.C. voltage.)	138	124
4. <u>RIPPLE.</u>	AUXILIARY SUPPLY (R.M.S. Voltage across Series Valve Screen Grid smoothing capacitor.)	0.1	0.3
5. <u>VOLTAGE.</u>	NEGATIVE SUPPLY (Unregulated D.C. voltage across negative supply smoothing capacitance.)	405	390
6. <u>RIPPLE.</u>	NEGATIVE SUPPLY (R.M.S. Voltage across negative supply smoothing capacitance.)	0.3	0.8
7. <u>VOLTAGE.</u>	D.C. BIAS (V _{gk}) ON POSITIVE LINE SERIES VALVES.	54	13
8. <u>VOLTAGE.</u>	D.C. BIAS (V _{gk}) ON NEGATIVE LINE SERIES VALVE.	30	24
9. <u>VOLTAGE.</u>	EXTERNAL 6.3v. 10A. OUTPUT. (A.C. Volts).	6.5v	6.3v
10. <u>CURRENT.</u>	MAINS INPUT (measured with taps correctly set and input of 230v.) Models: 510, 511.	0.5A	1.8A
	512, 513.	0.6A	2.0A
11. <u>VOLTAGE.</u>	D.C. VOLTAGE ACROSS REFERENCE TUBE (V _{ak} .)	84.5	($\pm$ 1.5)v.
12. <u>VOLTAGE.</u>	D.C. VOLTAGE ACROSS FILAMENT OF PREAMPLIFIER VALVE.	0.64	($\pm$.04)v.

NOTES.

1. All readings taken at correct nominal supply voltage (frequency 50 cps) on Model 8 AVOMETER or equivalent 20,000 ohms/volt instrument.
- ii) Negative Line readings are not applicable to Models 510, 511.
- iii) PREAMPLIFIER VALVES in high stability models only. 511, 513.
- iv) R.M.S. Ripple Voltage measured on C.R.O. or Avometer Model 8, with 10 MFD blocking capacitor of suitable working voltage.

MP MASTER



MA22647